EFFECTS OF TILLAGE METHODS ON WEEDS POPULATION IN SECOND CROP SOYBEAN *(GLYCINE MAX. MERIL L.)*

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Abstract: *The aim of this study was to determine the effects of different tillage methods on weeds population in second crop soybean production. The experiment was conducted at the experimental area of Agrıcultural Faculty at Dicle University in 2014. The treatment was lay out at the randomized complete blocks design with three times replication. In this study, different six tillage method were applied (one conventional tillage (CT) – four conservation tillage (RT) and direct sowing (NT)). There were observed more density the species of Xanthium strumarium subsp., Solanum nigrum L., Euphorbia helioscopia L., Convolvulus arvensis L. and Sorghum halepense (L.) Pers in experimental area than other weed species. According to results, there were found significant difference between treatments. The lowest values of weeds were recorded in the conventional tillage methods (CT), while the highest values of weeds were noted in RT4 Tillage methods and NT. Therefore, conventional tillage method was beneficial and useful in reducing of weeds population on soybean crop.*

Keywords: SOYBEAN, TILLAGE, WEED, CONVENTIONAL TILLAGE

1. Introduction

Soybean (Glycine max L.) is among the most important arable crop and the major sources of food in worldwide and it plays an important role in healthy nutrition because of its valuable composition. It contains 36-40% protein, 18-24% oil, 26% carbohydrates and 18% mineral substances. Because of these valuable nutrients, it is known as the wonderful plant of the century (Arıoğlu, 2007). In soybean oil, there were a lot of vitamin such as, Ca, Fe, Zn mineral and A, B1, B2, C, D, E, K vitamin, therefore it is so important for human and animal food.

To increase production and reduce production cost in soil tillage operations, reduced tillage and direct seeding system is of great importance. Appropriate tillage and sowing technique can reduce factors that impede seedling emergence reduce energy and labor cost, and weed control during the growing period. However, tillage systems are location specific; their success depends on soil, climate and local practices (Bayhan et al. 2006; Ozpinar and Cay, 2006; Sessiz at al., 2009). Especially weed control in agricultural cultural practices is so expensive among applications. Weeds have an adverse effect on crop yields as a result of competition with cultivated plants. The highest yield on soybean was found in CT method and the lowest yield was found in NT method (Sessiz at al,. 2009). The best result for silage yield was found in tillage combination. The lowest yield was found in the heavy-duty disc harrow tillage method (Bayhan et al. 2006). In addition, crop loss caused by weeds are 33.8% while soil erosion is 13.16%, disease and damage are 35.8% (Rangasamy ve ark., 1993). The crop yields have been loosed between 20-100% that due to weeds population (Özer, 1993). About fifty percent of production cost in agricultural activities are used for weed control. In a study conducted with the sorghum plant (Rangasamy ve ark., 1993), it was determined that were required for all maintenance grubber about 560 hours on the weed struggle, while 1536 workers working hours per hectare. In single hand weeding, the labor requirement can reach from 300 to 1200 man h ha^{-1} (De Datta et all.1974).

The weed control in soybean is done mostly by hand and cultivator. Because the manual weed struggle is a tedious, time-consuming and expensive process that's why the mechanicals struggle are so importance in weed control processes. The mechanically weed struggle does not only destroy weeds but also increases the aeration of the soil and the water conservation. Özaslan and Gürsoy (2015) reported that the effects of the tillage treatments on weed density differed among the weed species. *Sorghum halepense* had the highest density under the reduced tillage method, while the *S. arvensis* density increased under the conventional tillage treatment.

The germination of weed seeds or the application of the vegetative propagation organs varies depending on the soil temperature, light, light soil handling patterns and processing depth. As the chemical struggle leads to environmental pollution that's why the mechanical struggle is important as alternative method of struggle. In this study, the effects of soil treatment methods on weeds in soybean crop.

In recent years in Turkey, especially due to introduction of agricultural irrigation in Southeastern Anatolian region has lead to a dramatic increase in irrigating farming and thus second crop farming have gained importance. Conventional tillage methods using by all farmers in this region result in physical degredation of soil and increased soil erosion, lobour, time, energy and production costs (Sessiz et al., 2009).

The main objective of this work was to evaluate the effects of different tillage methods on weed control in field conditions for second crop soybean in southeastern part of Turkey.

2. Material and Methods

The field experiment was conducted during the summer of 2014 at the experimental area of Agrıcultural Faculty at Dicle University, Diyarbakir Province (latitude 37°53´N and longitude 40°16´E, 680 m altitude), Turkey. In this study, SA-88 soybean variety was used as second crop. The analysis of soil in experimental area were determined as 71.1% (clayey), 1.25% (organic matter), 1.63kg da^{-1} (phosphorus), 13.02%(calcareous), saltless and mid-alcali (pH 7.73) in laboratory of GAPUTAEM (GAP International Agricultural Research and Training Center, Diyarbakır). The average weather conditions such as annual temperatures, relative humidity, and rainfall are summarized in Table 1.

The average temperature in June-December period was conducted 26.28^0C, average moisture was 33.98% and average rainfall 16.72 mm. Tillage treatments in 2014 consisted of six tillage methods that are described in Table 2. The specification of the tools used in the experiments are given in Table 3.

***Table 1**. Monthly means of temperature, humidity and rainfall*

	Months											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Avrg. Humidity(%)	82.1	53.6	68.3	63	53.7	29.6	22.4	21.5	35.5	60.9	70.2	87.9
Max. Temp.(^{0}C)	9.2	16.8	22	19.6	26.3	31.6	42	42.1	31.3	30	19.7	16
Min. Temp.(^{0}C)	-1	4.9	6.9	6.4	16.3	18	26.4	25.8	16.5	10.5	4.7	-3.6
Avrg. Temp (^{0}C)	3.4	5.4	10.8	14.7	19.7	26.5	31.5	31.1	24.8	17.5	8.5	6.6
Tot. Rainfal.(mm)	43	17	60.6	39.9	48.8	21.4	0.6	0.0	27.4	34.2	97.6	73.4

Source: Diyarbakır Meteorology Bulletin (2014)

***Table 2**. Soil tillage methods utilized in experiments*

I. Conventional Tillage (CT)	Plough + Disk harrow + Float + Direct seeding machine
II. Reduced Tillage (RT1)	Disc harrow + Float + Direct seeding machine
III. Reduced Tillage (RT2)	Stripe tiller by rotary + Float + Direct seeding machıne
IV. Reduced Tillage (RT3)	Cultivator + Float + Ridge tillage + Direct seeding machine
V. Reduced Tillage (RT4)	Cultivator + Float + Direct seeding machine
VI. No-Till (NT)	Seeding by direct drill

***Table 3**. The specification of the tools used in experiment*

Tool	Type	Working depth (cm)	Working width (m)	Working speed (m/s)
Moldboard plough	Four bottom	30-35	1.42	0.50
Heavy disk harrow	24 disk - tandem	15	2.5	0.45
Cultivator	11 sweeps	15	3.10	0.45
Rotary tillage	Four row	12	2.8	0.45
Ridge tool	-	-	0.7	0.40
Float	-	-	2.9	0.60
Direct planter	Four row	4-6	2.8	0.40

Experimental areas were design as 18 plots with each measuring 12 m x 6 m. Before sowing, the experiment area was irrigated eight hours with sprinkler irrigation system. After irrigation, soil tillage operations were made and after soil tillage applications, seed planting was performed by pneumatic planter with an inter row spacing of 0.7 m distance on 23 June 2014. Massey Ferguson tractor was used in the experiments. Travel speed of tractor was changed depend on tools (Table 4).

***Fig. 1.** The view of experimental area during the growing.*

***Fig. 2.** The view of experimental area during the growing.*

After emergence of weeds, two times weed counted, the first weed count was made 30 days after sowing. Just the first count of weeds, all of the weeds in plots was manually removed by worker (Figure 1 and Figure 2). The second count of weeds was made after 30 days of the first count. Weed count each plot of 3 replicates 1 m^2 frame randomly discarded and the according to weed species have been counted in the remaining frame. No herbicide was applied to the field both before and after tillage. The treatment was lay out at the randomized complete blocks design with three times replication. Data was subjected to an analysis of variance (ANOVA) using a statistical software package (JMP version 5.0.1a). Least significant difference (Tukey's HSD test) was used to compare treatment means at P=0.05.

3. Results and Discussion

The average values of variance analysis and Duncun's test results are given in Table 4 and 5. There was observed more density the species of *Xanthium strumarium subsp., Solanum nigrum L., Euphorbia helioscopia L., Convolvulus arvensis L. and Sorghum halepense (L.) Pers* in field during growing season than others weed species.

***Table 4.** Analysis of variance (mean square) for weeds population*

VK	DF	First Count	Second Count
		F Ration	F Ration
Practies	5	5.30*	7.80*
Replication	2	2.12	0.52
CV		23.6	13

** 0.05*

As it can be seen from Table 4, statistically significant differences were found among the tillage methods on weeds population.

Weed density was found between 25.6-66.3 plant m^{-2} at the first count. The highest values of weed density was found in RT4 tillage methods as 66.3 plant m^{-2} other hand the lowest values was determinate in CT tillage methods as 25.6 plant m^{-2} at first count (Table 4). Weed density of the second count was found highest values in V. Tillage methods (65.3 plant m^{-2}) than CT tillage methods (35.6 plant m^{-2}). Similar result were reported by Çoruh and Boydaş (2007), according theirs results the lowest weed density were found in CT methods and deep tillage methods. Also similar result was determined by Güncan (1975).

Table 4. *Tillage treatment and weeds population*

Practies	Weed Population	
	First Count	Second Count
CT	25.6 c	35.6 d
RT1	40 ab	45.6 cd
RT2	47.6 ab	49.3 bc
RT3	40 bc	44.6 cd
RT4	59 ab	65.3 a
NT	66.3 a	58 ab
LSD	20	11.8

CT: Conventional Tillage RT: Reduce Tillage NT: No-Tillage

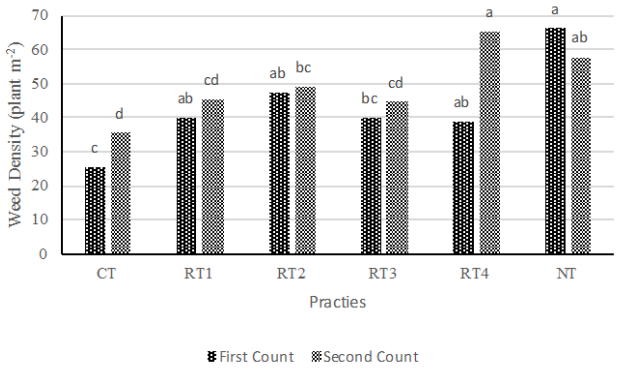

Fig. 2. *Weed population (plant m^{-2})*

The higher weed density values were found in second count than the first count in this study. However, both the first count and the second count, the highest values were observed in NT treatment. The lowest values were obtained CT tillage methods (Figure 1). According to second count of weed density was obtained highest values in reduce tillage and no tillage than conventional tillage methods. *Xanthium strumarium L.* is one of the most prevalent and competitive weeds in the Southeastern United States (Snipes et al. 1982) and is listed among the most common and troublesome weeds in peanut, cotton (*Gossypium hirsutum L.*), and soybean (*Glycine max (L.) Merr.*) grown in the region (Dowler 1995; Royal et al. 1997). *Xanthium strumarium subsp.* that can continue to grow after soybeans have flowered may be more competitive with soybeans. Barrentine (1974) reported that Mississippi common cocklebur achieved a maximum height of 200 cm in 96 cm tall soybeans. Soybean plants reached maximum height 10 week after emergence, whereas common cocklebur reached maximum height 16 week after emergence. Royal et al. (1997) reported that a Florida common cocklebur had maximum dry weight yield of 17,000 kg ha-1 when harvested 20 weeks after emergence. The reduction in soybean seed yield was less than 10% when common cocklebur was removed 6 weeks after soybean emergence. *Xanthium strumarium subsp.* may grow to heights of 150 cm and have a root depth and radius of 2.9 and 4.3 m, respectively (Bloomberg et al. 1982). Çelik and Altıkat (2006) reported that weed population is higher about % 30-40 in conventional tillage system than reduced tillage system.

4. Conclusion

Significant differences were found between Conventional tillage (CT) and no-tillage (NT) methods. The weeds are so problem for yield and yield component for soybean. Generally, weed rates were found to be high for no-tillage methods in treatment. As a results, it can also be concluded that conventional tillage method was beneficial and useful in reducing of weeds population in second crop soybean.

5. References

Arıoğlu, H.H. 2007. Yağ Bitkileri Yetiştirme ve Islahı., Çukurova Üniversitesi Ziraat Fakültesi Ders Kitapları, Yayın No: A-70, S:204. Adana.

Barrentine, W. L. 1974. Common Cocklebur Competition in Soybeans, Weed Science, Vol: 22, P: 600-603.

Bayhan, Y., B. Kayisoglu, E. Gonulol, H. Yalcin and N. Sungur, 2006. Possibilities of Direct Drilling and Reduced Tillage in Second Crop Silage Corn, Soil & Tillage Research, 88: 1-7.

Bloomberg, J.R., Kirkpatrick, B.L. ve Wax, L.M. 1982. Competition of Common Cocklebur (*Xanthium pensylvanicum*) with Soybean (*Glycine max*). Weed Sci. 30, 507-513.

Çelik, A. ve Altıkat, S. 2006. Farklı Toprak İşleme Yöntemlerinin Yabancı Ot Kontrolüne Etkisi, Tarım Makinaları Dergisi. 2(4), 293-302.

Çoruh, İ. ve Boydaş M. G., 2007. Buğday Tarımında Değişik Toprak İşleme Aletlerinin ve Çalışma Hızlarının Yabancı Ot Yoğunluğu Üzerine Etkisi. Yüzüncüyıl Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi (J. Agric. Sci.), 17(1), 29-43.

De Datta S.K; Aragon, K. L; Malabugoe J.A. Varietal Differences in and Cultural Practices for Upland Rice, Seminar Proceedings I. Rice breeding and varietal environment. West Africa Rice Development Association, Monrovia, Liberia 1974,35-73

Dowler, C. C. 1995. Weed Survey Southern States Broad Leaf, Crops Subsection, Pages 290–305

Güncan, A., 1975. Erzurum Çevresinde Bulunan Yabancı Otlar ve Önemlilerinden Bazılarının Yazlık Hububatta Mücadele Imkanları Üzerine Araştırmalar. Atatürk Üniversitesi Yayınları, No: 446, Erzurum, 79 s.

Özpinar S., Cay A. 2006. Effect of different tillage systems on quality and crop productivity of a clay-loam soil in semi-arid north-western Turkey. Soil Tillage Res., 92, 69-78.

Özaslan C., and Gürsoy, S., 2015. The Effect of Conventional And Reduced Tillage Systems on Grain Yield And Weed Species Density In Common Vetch (*Vicia Sativa L.*) Production. Agriculture & Forestry, Vol. 61, Issue 3: 53-59.

Özer, Z., 1993. Niçin Yabancı Ot Bilimi (Herboloji), Türkiye I. Herboloji Kongresi Bildirileri, 3-5 Şubat 1993, 1-7

Rangasamy, K., M, Balasubramanion and K.R. Swaminathon. 1993. Evaluation of Power Weeder Performance, AMA Vol.24 (4):16-18

Royal, S.S., Brecke, B.J. ve Colvin, D.L. 1997. Common Cocklebur (*Xanthium Strumarium*) Interference with Peanut (*Arachis hypogaea*), Weed Science, Vol: 45, P:38.43.

Sessiz, A., Söğüt, T., Temiz, M.G., Gürsoy, S., 2009. Yield and Quality of Soybean (*Glycine Max.L.)* Sown as Double Crop Under Conservation and Conventional Tillage System in Turkey, Res. On. Crops. 10(3): 558-565.

Snipes, C. E., G. A. Buchanan, J. E. Street, and J. A. McGuire. 1982. Competition of Common Cocklebur (*Xanthium Pensylvanicum*) With Cotton (*Gossypium Hirsutum*). Weed Science, Vol: 30, P:553-556.